

TOLERANCE OF SEVERAL FLOWER SPECIES TO HERBICIDES

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SUMMARY

From a preliminary review of literature, candidate herbicides were chosen for a screening programme on five flower species being grown commercially. *Xeranthemum* tolerated chlorthal and oryzalin. *Gypsophila* tolerated oxadiazon. *Limonium* tolerated chlorthal, lenacil, oryzalin and oxadiazon. *Nigella* tolerated asulam, chloramben, chloridazon, chloroxuron, chlorthal and lenacil. *Delphinium* tolerated chlorthal, diphenamid and lenacil. All five species tolerated fluzafop-butyl.

INTRODUCTION

A research programme was conducted at Levin HRC during 1986 to screen for suitable herbicides to assist commercial production of five flower species, namely:

<i>Xeranthemum</i> sp., Everlasting daisy	Compositae
<i>Gypsophila paniculata</i> , Gypsophila	Caryophyllaceae
<i>Limonium sinuatum</i> , Statice	Plumbaginaceae
<i>Nigella damascena</i> , Love in the mist	Ranunculaceae
<i>Delphinium consolida ambigua</i> , Larkspur	Ranunculaceae

These were being grown as direct-sown field crops for dried flowers in Central Otago. The programme included a review of literature, preliminary herbicide screening tests and, finally, a programme of more detailed experiments. This paper summarises the information gained from published literature and reports on the findings of the main experiments.

Information available from the literature is summarised in Table 1. Almost all published experience in the relevant botanical families is with herbicide applications made before weed emergence and, most commonly, chloroxuron, lenacil, simazine and trifluralin are mentioned. Others which have shown promise are asulam, chlorpropham, prometryn, propachlor and propyzamide.

Following preliminary screening ten trials were carried out, one of pre-emergence applications and one post-emergence for each of the five species. These are described below.

METHOD

Seed lots of the five species were supplied by Queenstown Dried Flowers Ltd. Germination tests were carried out in a cabinet at 24°C. *Limonium* germinated quickly and completely; *Nigella* also had good viability though germinating more slowly. *Xeranthemum* and *Gypsophila* germinated in a few days with fairly good viability. The emergence of *Delphinium* was rather uneven and extended suggesting that this species may have preferred the cooler and lower light conditions of the preliminary experiments sown 7 weeks earlier.

The experiments, were sown in late August 1986. Glasshouse heating during the night maintained temperatures between 13 and 14°C. In the middle of the day temperatures usually rose to 20°-25°C for several hours.

Plants were grown in 200 ml polystyrene cups, each with a drainage hole in its base and standing in a foil dish. The growing medium was sieved Wakatipu soil and clean

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TABLE 1: Summary of literature reports of tolerance to herbicides in relevant families.

Family and genus	Herbicide	Reference number*
<i>Compositae</i>		
Xeranthemum	chlorpropham	10
	carbetamide	10
<i>Caryophyllaceae</i>		
Gypsophila (125 spp.)	chloroxuron	3, 8
	dichlobenil	3
	lenacil	3, 4, 9
	oxadiazon	7, 9
	prometryn	3
	simazine	2, 3, 9
<i>Plumbaginaceae</i>		
Limonium (300 spp.)	chlorthal	9
	lenacil	4
	simazine	2
	trifluralin	9
<i>Ranunculaceae</i>		
Delphinium	asulam	6
	lenacil	3, 4, 5
	methabenzthiazuron	1
	metoxuron	1
	pendimethalin	1
	propachlor	9
	simazine	3
	trifluralin	4, 5
	Nigella (20 spp.)	asulam
chloroxuron		10

***Key to references:**

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|------------------------------|-------------------------------|
| 1. Anon., 1978 | 6. Hoogstrate, 1986 |
| 2. Anon., 1983 | 7. Lamont and O'Connell, 1986 |
| 3. Bateman, 1971 | 8. Possner, 1972 |
| 4. Devoy, 1976 | 9. Romano, 1980 |
| 5. Fryer and Makepeace, 1979 | 10. van Staalduine, 1982 |

river sand, mixed by volume in the proportion 3 to 2 respectively. Seeds were sown approximately 8 mm deep and the surface gently tamped flat. All species were sown with 10 seeds per pot, except for *Limonium* (two seeds per pot). These were thinned, for the post-emergence experiments only, to four plants per pot, except for *Limonium* which were thinned to one plant per pot.

All pots were sub-irrigated. The first irrigation contained a fungicide to prevent 'damping off'. Thiram was used for *Delphinium* and captan for the others, 4 g of 80% product per litre of water in both cases. A liquid feed solution of Nitrophoska N:P:K = 12:10:10, 1 g per 2 litres of water, was used on seven watering occasions.

In the pre-emergence experiments, a total of 16 herbicides was applied to the soil. The post-emergence experiments tested five herbicides plus one mixture. All experiments contained four replicates. Details of herbicides, rates and type of application tested on each flower species are listed in Table 2. Where there is no entry, that combination of herbicide and flower species was not included, as a result of information gained in preliminary tests. The four pots to be sprayed in each treatment were placed in a laboratory spray booth and herbicides applied in a volume equivalent to 412 litres/ha. Spray pressure was 140 kPa. Soil treatments were applied 1-3 days after sowing and foliage treatments were applied 41 days after sowing.

TABLE 2: Mean plant weight, as percent of untreated, of five flower species treated with herbicides.

Herbicide	kg ai/ha	<i>Xeranthemum</i>	<i>Nigella</i>	<i>Limonium</i>	<i>Gypsophila</i>	<i>Delphinium</i>	
(a) Soil application							
alachlor		11*	37*	3*	44*	109	
(Alachlor)	50% ec	1.4	8*	43	2*	22	71
asulam		3.0	45*	108			100
(Asulox)	40% AC	6.0	15*	92			79
aziprotryne		1.0			2*		53*
(Brasoran)	50% wp	2.0			2*		29*
carbetamide		2.0	79		41*		
(Carbetamex)	30% ec	4.0	84		11*		
chloramben		3.0		101	26*		87
(Amiben DS)	83% wsp	6.0		100	17*		49*
chloridazon		1.0	49*	92	63	8*	89
(Pyramin)	80% wp	2.0	20*	104	83	10*	54*
chloroxuron		3.0	17*	102	36*		84
(Tenoran)	50% wp	6.0	7*	101	85		96
chlorpropham		1.0	84				
(Chloro-IPC)	40% ec	2.0	33*				
chlorthal-dimethyl		5.0	133	116	112		101
(Dacthal)	75% wp	10.0	75	131	79		102
diphenamid		2.5	63	101	75		89
(Enide)	50% wp	5.0	92	106	63		96
lenacil		0.8	65	103	98	97	86
(Venzar)	80%	1.6	42	103	75	121	96
linuron		0.5			5*		
(Linuron)	50% wp	1.0			2*		
oryzalin		3.0	92	74*	126	8*	70
(Surflan)	75% wp	6.0	65	73*	96	5*	57*
oxadiazon		1.0			98	99	
(Foresite)	40% sn	2.0			105	121	
propachlor		3.0					84
(Propachlor)	65% wp	6.0					53*
propyzamide		1.0	45				
(Kerb)	50% wp	2.0	68				
(b) Foliage application							
chloroxuron		1.5	75	71	74	99	23*
(Tenoran)	50% wp	3.0	27*	39*	56	94	27*
		6.0	27*	13*	13*	54*	11*
phenmedipham/ desmedipham		0.4		75	91		35*
(Betanal AM 11)	16.5% ec	0.8		42*	78		32*
		1.6		25*	66		3*
fluzipfop-butyl		0.6	108	96	98	95	82
(Fusilade)	25% ec	1.2	112	86	105	99	79
metamitron		3.0	5*	51*	54	56*	48*
(Goltix)	70% wp	6.0	3*	10*	6*	11*	18*
methabenzthiazuron		1.0		4*			
(Tribunil)	70% wp	2.0		4*			
oxadiazon		1.0		71	89	101	54*
(Foresite)	40% sn	2.0		73	99	95	56*
Untreated			100	100	100	100	100

* = statistically lower than untreated, at 5% significance

The plants were grown on and assessed when treatment effects had developed. Assessment was by plant counts, vigour scores using a scale 0 (= least) to 10 (= most vigorous), observation of symptoms (e.g. distortion, necrosis, chlorosis of foliage) and, finally, fresh weighings of above-soil parts. Average time intervals to final weighings were 37 days for the soil treatments and 18 days for the foliage treatments.

RESULTS AND DISCUSSION

Table 2 gives final results of plant fresh weights expressed as percentages of untreated values. Treatments are marked with an asterisk when they have caused a statistically significant reduction in growth.

The grass killer, fluazifop-butyl was well tolerated by all species tested. Other herbicides best tolerated by the various species, as judged by all assessments (injury, vigour scores and plant weights) were as follows.

- Xeranthemum*: Chlorthal-dimethyl, oryzalin. Carbetamide caused some leaf scorching. Chlorpropham was safe at the low rate only. Chloroxuron was safely applied to the foliage at the lowest rate.
- Nigella*: Asulam, chloramben, chloridazon, chloroxuron, lenacil. Chlorthal-dimethyl and diphenamid caused slight injury. Chloroxuron and phenmedipham/desmedipham were safely applied to the foliage at low rates only. Oxadiazon caused slight scorch.
- Limonium*: Chlorthal-dimethyl, lenacil, oryzalin. Chloridazon, diphenamid, oxadiazon and phenmedipham/desmedipham caused slight injury. Chloroxuron results were inconsistent but the low rate was safely applied to the foliage.
- Gypsophila*: Oxadiazon. Lenacil caused slight injury. Chloroxuron was safely applied to the foliage at low and medium rates.
- Delphinium*: Chloroxuron (soil treatment only), chlorthal-dimethyl, diphenamid, lenacil. Alachlor and asulam caused slight injury. Chloramben, chloridazon, oryzalin and propachlor were safe at low rates.

TABLE 3: Summary of selected promising herbicides for each species. (See Table 2 for application rates).

	<i>Xeranthemum</i>	<i>Nigella</i>	<i>Limonium</i>	<i>Gypsophila</i>	<i>Delphinium</i>
asulam		*			
chloramben		*			(*)
chloridazon		*			(*)
chloroxuron	(*)	*	(*)	(*)	*soil only
chlorthal-dimethyl	*	*	*		*
diphenamid					*
fluazifop-butyl	*	*	*	*	*
lenacil		*	*	(*)	*
oryzalin	*		*		
oxadiazon		(*)	*	*	

* = best tolerated herbicides (*) = tolerated at the lower rates

The main conclusions are summarised in Table 3. While definite recommendations could not be made without further field testing, this work gave some very useful leads.

Nigella tolerated the greatest number of more general herbicides and *Gypsophila* the least. Oxadiazon was best tolerated by *Limonium* and *Gypsophila*. Chlorthal-dimethyl showed promise for all species except *Gypsophila*. Chloroxuron damaged *Gypsophila* in preliminary tests. Lenacil generally had little effect but its future availability is uncertain.

Sub-irrigation was used to prevent the possibility of absorption of herbicide by adjoining pots; results may have been different from overhead irrigation.

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